Chapter

Local Anaesthetics for Spinal Anaesthesia in Day-Case Surgery

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Abstract

Day-case procedures require a high turnover, high quality and low costs. Lidocaine has long been the gold standard for ambulatory spinal anaesthesia. However, the risk of transient neurological symptoms (TNS) limits its use. The perfect local anaesthetic for spinal anaesthesia in day-case surgery should have fast recovery, fast voiding time and a low risk on TNS and urinary retention. Urinary retention is a result of prolonged sensory blockade of the pelvic nerves and is local anaesthetic dose and potency dependent. As a substitute for lidocaine, several local anaesthetics have been suggested in various doses or combinations with or without additives. However, not all are registered for spinal use or have a short-acting profile. The use of additives has been subject of debate because of possible delay in the recovery of bladder. Recently, the old local anaesthetics chloroprocaine and prilocaine were reintroduced in the market. They provide rapid recovery after spinal anaesthesia in day-case surgery. This chapter gives an overview of the local anaesthetics suitable for spinal anaesthesia in day-case surgery, the advantages and disadvantages and the influence on discharge time and recovery of bladder function.

Keywords: spinal anaesthesia, ambulatory surgery, local anaesthetics, urinary retention, transient neurological symptoms, lidocaine, bupivacaine, mepivacaine, prilocaine, chloroprocaine

1. Introduction

Day-case surgical procedures require an anaesthetic technique with the possibility of a high turnover, a high quality of care and low costs [1]. Spinal anaesthesia is an easy and cheap technique, has a fast onset and causes minimal side effects. Urinary retention and transient neurological symptom (TNS) are side effects of spinal anaesthesia and reason for some anaesthetists only to provide general anaesthesia in day-case surgery. Despite the fact that these side effects are mostly temporary, they affect the quality of care to a great extent.

Lidocaine is a short-acting local anaesthetic and was frequently used for spinal anaesthesia in day-case surgery until it became clear that the incidence of TNS is significantly higher than with other local anaesthetics [2].

The ideal spinal anaesthesia for day-case surgery provides a rapid onset and a short duration of action, allowing a fast turnover of patients for a double-bed planning. Spontaneous voiding is still a discharge criterion in our and many other hospitals: faster spontaneous voiding results in faster discharge.

Urinary retention after spinal anaesthesia is most often a result of a prolonged sensory blockade of the pelvic nerves. The duration of a spinal block is local anaesthetic dose and potency dependent [3]. The dose of a local anaesthetic to provide adequate surgical anaesthesia can be lowered by using spinal additive drugs [4]. Opioids and clonidine prolong the duration and increase the quality of the sensory nerve block in spinal anaesthesia. By adding spinal clonidine, the local anaesthetic dose can be reduced without increasing the risk of block failure [5]. The question rises if the benefit of lowering local anaesthetic dose outweighs the side effects of the additive administered.

The incidence of urinary retention after spinal anaesthesia has been reported with a high variability. There is neither uniformity nor consensus when to catheterise [6]. Fluid policy has also been a subject of debate. A restrictive fluid policy is a way of preventing bladder filling, but a more liberal schedule could speed up the time to void and fasten discharge time. Furthermore, there is an enormous interpatient variability in bladder capacity and in the definition of urinary retention.

Different techniques exist to perform spinal anaesthesia, producing selective spinal anaesthesia by changing baricity, dose and position, like a saddle block or unilateral anaesthesia. Little is known about the effects of these techniques on the restoration of bladder function.

2. Spinal anaesthesia in day-case surgery

2.1 History of local anaesthetics for day-case surgery

In 1954, lidocaine was introduced and became very popular for spinal anaesthesia because of its favourable profile for day-case surgery [7]. In 1993, TNS were described after its use [8]. Subsequently, additional case reports and prospective trials were published about the appearance of TNS with lidocaine [9–11]. In 2005, a meta-analysis from Zaric et al. clearly demonstrated an increased risk when lidocaine was used for spinal anaesthesia. However, many physicians were not really concerned by these symptoms because they were transient and lidocaine remained very popular. Even up to now, some clinicians still prefer lidocaine.

The appearance of TNS did initiate a quest for the replacement of lidocaine to provide cost-effective, short-acting spinal anaesthesia with a low incidence of side effects. It should also be noted that with the progression of modern medicine, patient satisfaction became more important as an indicator of the quality of care. Temporary side effects that were not considered very important previously now became clinically relevant.

2.2 Spinal anaesthesia: advantages and disadvantages

Spinal anaesthesia is an easy technique that has proven its benefit for many years [12]. After injection of the local anaesthetic solution in the CSF, it provides good surgical anaesthesia for procedures below the umbilicus. The incidence of PONV is low and allows eating and drinking immediately after the procedure.

Although the incidence is low, spinal anaesthesia can fail by producing an insufficient block height or a patchy block [13]. The duration of spinal anaesthesia cannot be extended when the duration of surgery outlasts surgical anaesthesia. When this happens a conversion to general anaesthesia must be made.

Several side effects can occur after injection of the local anaesthetic. Sympathetic block, hypotension and cardiovascular depression can occur, especially when block height exceeds the fifth thoracic dermatome or when patients are of older age [12].

Late side effects from spinal anaesthesia are urinary retention, TNS, backache and PDPH. Bleeding or abscess formation are rare but can occur.

To prevent PDPH, smaller and non-cutting needles were developed with a pencil-point-shaped tip. This atraumatic needle tip separates the dural fibres rather than cutting them, with a lower risk of CSF leakage after puncture. After introduction of these needles, the incidence of PDPH dropped to 0.6–3% [14, 15].

TNS are described as a dull bouncing pain or dysesthesia at the gluteal region or lower limbs after spinal anaesthesia. The symptoms mostly occur within 24 h after block regression, and there is an interval of 2–5 h between mobilisation and onset of the symptoms [16]. The pain mostly disappears within 5 days, but a duration of 3 weeks has been described [17]. The aetiology of these symptoms is not well understood. A neurotoxic mechanism is suspected although no neurologic disorders are observed. Lidocaine and mepivacaine show the highest incidence of TNS, but they are described for other local anaesthetics as well [18]. Lidocaine concentration and osmolarity, early ambulation, age, needle size and level of puncture all have been suggested as contributing factors, but the evidence in literature is weak and controversial. Ambulatory anaesthesia, the lithotomy position and knee arthroscopy are known to be risk factors [10, 11, 19–22].

2.3 Comparison with other anaesthetic techniques

Spinal and general anaesthesia have frequently been compared in literature. In 2005, a meta-analysis compared different locoregional techniques with general anaesthesia for ambulatory surgery [23]. After including 23 trials with more than 1000 patients, it was concluded that general anaesthesia had a faster onset and a 40 min faster discharge time than spinal anaesthesia. However postoperative pain scores and the incidence of PONV were higher for general anaesthesia. Patients were equally satisfied with all techniques. Comparison of costs was not part of the analysis. After this meta-analysis, more recent studies confirmed the delay in discharge but also showed an increase in urinary retention for spinal anaesthesia. Less PONV and lower pain scores after spinal anaesthesia were consistent findings [24–28].

Spinal anaesthesia displays a clear advantage concerning PONV and postoperative pain scores. It is clear that we should improve recovery time and lower the incidence of urinary retention and TNS when spinal anaesthesia has to compete with general anaesthesia. It is important to realise that the choice of drugs and equipment only has a minor contribution in anaesthesia expenses compared to personnel costs. Reducing turnover times and fasten recovery and discharge have an economical benefit because of saving manpower. Unanticipated admissions and the occurrence of side effects are cost-increasing factors [29, 30].

A limitation in many studies has been the use of long-acting local anaesthetics, while short-acting local anaesthetics might provide a faster recovery [31].

When it comes to difference on the longer-term outcome, there is not much evidence of superiority of spinal or general anaesthesia. One prospective randomised trial with 200 patients suggests that success rate with in vitro fertilisation might be improved from 15 to 27% when spinal anaesthesia is used instead of general anaesthesia [32].

Postoperative cognitive dysfunction (POCD) is a decline in mental status after surgery. The mechanism is not understood. In 2007, a review by Newman showed that there is no difference in the incidence of POCD after general or spinal anaesthesia [33]. However, the author points out that many studies were underpowered and differences in surgery and testing provided difficulties in methodology. For elderly patients undergoing hip replacement, neuraxial anaesthesia lowers the risk of POCD than general anaesthesia [34].

2.4 Spinal anaesthesia and bladder function

Neuraxial anaesthesia increases the risk of urinary retention since the neurophysiology of the bladder is temporarily disturbed. The duration is dependent on the local anaesthetic used [3, 35, 36]. The temporary malfunction of the detrusor muscle and the lack of urge sensation during spinal anaesthesia increase the risk of bladder distension.

The time for the bladder function to restore relates to the duration of the block, which is determined by local anaesthetic potency and dose. When long-acting local anaesthetics are used, more time is required before bladder function is restored than short-acting substances. When local anaesthetic dose is increased, the time to void is prolonged as well. This causes variable times to void after spinal anaesthesia, ranging from 103 (chloroprocaine) to 462 min (bupivacaine) [3, 37]. To prevent bladder retention in an outpatient setting, the use of short-acting local anaesthetics and voiding before surgery is recommended [38].

In a day-case setting, the incidence of urinary retention after spinal anaesthesia varies between 0 and 30%, although there is consensus that the mean incidence is around 2% [3]. This variability can be explained by the difference in definition, catheterisation protocol and surgical procedure between the reported trials. There are a lot of studies concerning spinal anaesthesia in day-case surgery where urinary retention is not even mentioned. It is remarkable though that when trials were designed to study bladder function, high incidences like 23–30% are found [39, 40]. This may be explained by the closer monitoring of bladder volume.

2.5 Modifying spinal anaesthesia

Different aspects of spinal anaesthesia can be modified (**Figure 1**). Changing the solution for spinal injection, the anaesthetic technique or fluid policy can influence the duration of the sensory and motor block, the risk of certain side effects or discharge time. Modifying certain discharge criteria, like the necessity to void, can influence discharge time as well.

Figure 1.
Variables in spinal anaesthesia for day-case surgery.

2.5.1 Local anaesthetics

When a local anaesthetic substance is injected into the CSF, it diffuses through the lipophilic nerve membrane and reaches the sodium channel [41]. As a consequence, the sodium channel is blocked and impulses cannot be conducted along the different nerve fibres. This results in a sensory, motor and sympathetic block. After a certain period, the local anaesthetic molecules dissociate from the sodium channel and are absorbed in the blood stream to be degraded. Local anaesthetics are divided in two groups: amides and esters. Amides are degraded by the liver, and esters are rapidly hydrolysed by pseudocholinesterases in the blood stream. Every local anaesthetic has its own pharmacologic properties (pKa, liposolubility, protein binding), which not only determine the potency but also the onset and duration of the spinal block [42]. Since the first spinal anaesthesia was performed with cocaine, more local anaesthetics have been produced (**Figure 2**).

The duration of the sensory and motor block is dose dependent in neuraxial anaesthesia. Increasing local anaesthetic dose prolongs motor and sensory block. Winnie stated that locoregional anaesthesia always works provided you put the right dose of the right drug in the right place. This is also true for spinal anaesthesia. Unfortunately for spinal anaesthesia in day-case surgery, a working spinal

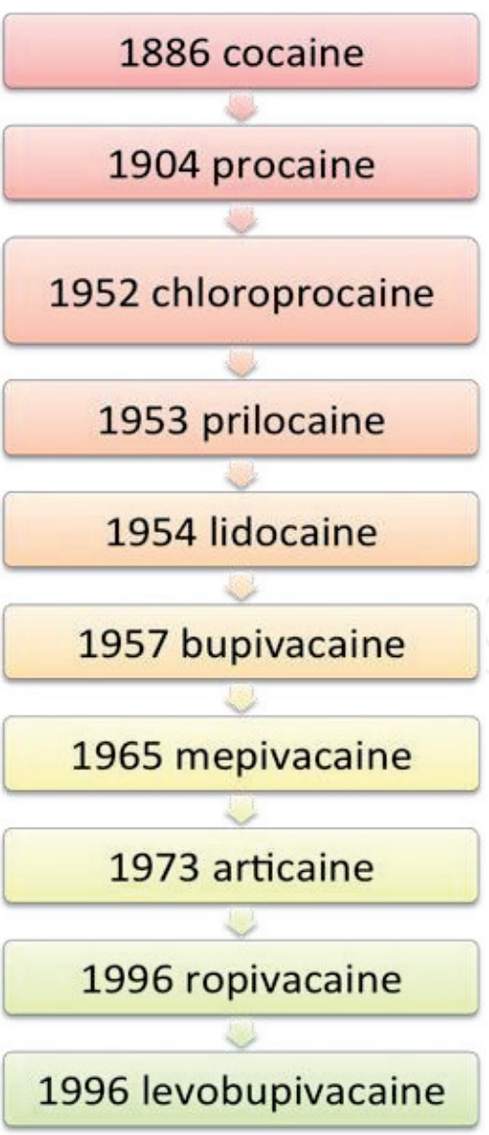

Figure 2.
Different local anaesthetics and year of production.

anaesthesia is not enough. The duration of the spinal block should be short but long enough to do provide surgical anaesthesia with a minimal risk of insufficient block height and with minimal side effects.

Lidocaine has always been a popular drug for spinal anaesthesia. It can provide 60 min of anaesthesia below the umbilicus with minimal time to achieve discharge criteria [43, 44]. The question arises if lidocaine should still be used in the twenty-first century because of its side effects, and many studies have compared it to its alternatives [45, 46].

Bupivacaine is a long-acting local anaesthetic from the amide group and has a low incidence of TNS. It has been the most common alternative for lidocaine for years. Because of its pharmacological profile, the recovery of motor and sensory block is delayed compared to short-acting local anaesthetics. The incidence of postoperative urinary retention with long-acting local anaesthetics like bupivacaine and tetracaine is higher than with short-acting local anaesthetics [3, 47]. Successful spinal anaesthesia with low doses of bupivacaine between 5 and 10 mg without additives has been described for outpatients. The incidence of urinary retention was still 3.7–16% [48, 49]. Furthermore, with these low doses, block height becomes unpredictable and the risk of block failure is high [48, 50, 51]. A meta-analysis of 17 trials looked at the use of bupivacaine for ambulatory knee arthroscopy. This paper warned for an increased risk of a failed block with doses below 7.5 mg, unless a unilateral spinal technique was used or additives were administered to the solution [52].

Other local anaesthetics like procaine and mepivacaine also have a considerable risk of TNS or have an unfavourable profile regarding block resolution and discharge times [53, 54].

Levobupivacaine and ropivacaine are both amide local anaesthetics that have similar properties to bupivacaine. Ropivacaine also is a pure enantiomer, is less potent and produces less motor block than bupivacaine. Both products are not officially registered for spinal use but used "off-label" frequently. The recovery and discharge for ambulatory surgery is not as fast as lidocaine, and micturition problems are comparable [55]. There is controversy about the suggested faster recovery of ropivacaine compared to bupivacaine [56].

Although there is enough literature to support the use of these two products for spinal anaesthesia for ambulatory surgery, reintroduction of chloroprocaine and prilocaine, which are in many countries registered for spinal use, seems to have more advantages [57–59].

Chloroprocaine is a local anaesthetic from the ester group. It has a fast- and short-acting profile. It became unpopular in the 1950s after the publication of toxic neurologic symptoms, which were probably caused by the additives in the solution. The additive-free form is now approved an available for spinal use in Europe and is considered safe [60–62]. It has been shown to be suitable for spinal anaesthesia in day-case surgery and has a faster regression than long-acting local anaesthetics and available short-acting local anaesthetics [60]. The recommended dose varies between 40 and 60 mg for ambulatory surgery. Discharge times between 178 and 277 min are found. Up to date only one patient has been reported with TNS after spinal anaesthesia with chloroprocaine, demonstrating the low incidence of TNS and suitability for day-case surgery [63]. Furthermore the frequency of bladder retention is very low, even when a fluid preload is administered [64].

A meta-analyses of the advantage of the pharmacokinetic profile proofed to translate in a clinical advantage such as faster block regression, ambulation and discharge as well [65].

Prilocaine is an amide local anaesthetic with an intermediate duration of action after spinal administration. It never gained much attention because of the popularity of lidocaine. It is available in the hyperbaric form and provides anaesthesia for

75–90 min after spinal administration. The duration of the spinal block is prolonged compared to an equal dose of lidocaine, but combined with fentanyl it is a better alternative than bupivacaine for ambulatory knee arthroscopy [66]. Doses between 20 and 70 mg are described in literature, but 50 mg hyperbaric prilocaine seems sufficient for day-case arthroscopies, although rescue analgesia was necessary in 11 and 7.5% of the patients [67, 68]. The ED90 was 38 mg for bilateral spinal anaesthesia for knee arthroscopies [69].

The incidence of urinary retention after 60 mg prilocaine in a day-case setting was described as high as 23% [40]. Articaine is an amide local anaesthetic with intermediate potency and a short duration of action. It is an amide but differs slightly because it also contains an ester group and can be hydrolysed. Further metabolism and excretion is primarily in the kidneys [70]. Articaine provides faster motor and sensory block regression and earlier spontaneous voiding than prilocaine; low-dose bupivacaine and lidocaine A comparison of equal doses of spinal articaine and chloroprocaine showed faster block regression for chloroprocaine [71]. Unfortunately, articaine is not available everywhere and its use is off-label.

2.5.2 Baricity

The baricity of a local anaesthetic is defined as its density compared to the density of the CSF**.** Baricity partly determines the spread of the molecules in the CSF after injection. The molecules sink or float in the CSF depending on their relative gravity. Most local anaesthetics are isobaric or slightly hypobaric. It must be remembered that an increase in temperature of the solution can change baricity, making isobaric substances slightly hypobaric once injected [72]. Hyperbaric substances are also available. These solutions contain glucose.

When hyperbaric or hypobaric substances are used for spinal anaesthesia, the spread of the local anaesthetic can be influenced by changing the position of the patient. Hyperbaric substances might have a more favourable profile because of faster block regression. Hyperbaric lidocaine, ropivacaine and bupivacaine showed faster recovery than the plain solutions and with higher or comparable cephalad spread [73–76]. No differences were found between hyperbaric and plain chloroprocaine [77]. It is believed that hyperbaric substances produce a more cephalad block spread because the molecules are dragged down over the lumbar curve to the lowest level of the thoracic kyphosis when the patient is allowed to resume the supine position. This more cephalad spread of local anaesthetic might result in a dilution of molecules in the CSF and thus a lower "mg per segment" concentration. The time necessary to absorb the local anaesthetic molecules is shorter because of a lower concentration which might explain faster block regression of a hyperbaric substance than a plain local anaesthetic [78].

2.5.3 Additives

Local anaesthetics can be combined with other drugs to prolong the duration of sensory or motor block or increase the level or intensity of sensory analgesia. It also allows local anaesthetic dose reduction without shortening the duration of the block but with a more favourable recovery profile. For day-case surgery, several additives were studied to reduce local anaesthetic dose in a day-case setting.

Intrathecal opioids have a direct analgesic effect after binding on the opioids receptors that are present at the spinal cord level. This is mainly through their effect on the C and A-delta fibres. The mechanism by which opioids and local anaesthetics interact is not fully understood but results in an increased somatic analgesia without influencing motor or sympathetic blockade. Intrathecal lipophilic opioids, like

fentanyl and sufentanil, increase the quality and prolong the duration of sensory analgesia after spinal anaesthesia [4, 79].

For day-case surgery, the combination of a local anaesthetic with an opioid could provide fast-onset and sufficient analgesia without prolonged motor block. Side effects like respiratory depression, which can occur after spinal hydrophilic opioids, are not clinically relevant with low doses of lipophilic opioids [80].

However the incidence of pruritus after intrathecal opioids varies but can be severe [81]. A meta-analysis in 2011 evaluated the effect of intrathecal opioids. The analysis concluded that morphine provided longer postoperative analgesia up to 12 h but also increased the risk of respiratory depression and PONV. The addition of fentanyl increased the risk of pruritus but had no effect on respiration [82]. Extremely small doses such as 3 mg of bupivacaine or 20 mg of lidocaine in combination with an opioid have been described [83–85]. However as described above, opioids will also decrease the sensation of bladder fullness and weaken the detrusor contraction. This might delay voiding [86, 87]. This possible delay in voiding time could not be confirmed by all studies, but it is clear that it is dose dependent [6, 88, 89].

Clonidine binds alpha-2 receptors on the presynaptic C fibres and the A-delta fibres. It intensifies sensory and motor block, but the exact working mechanism is not known [90]. Clonidine allows local anaesthetic dose reduction. The advantage of clonidine compared to opioids is the lack of respiratory depression and pruritus as a side effect. However, marked haemodynamic changes and sedation can occur [5].

Vasoconstrictors decrease local anaesthetic uptake by reducing spinal cord blood flow. Epinephrine prolongs the duration and improves the quality of a spinal block in a dose-dependent fashion. It allows local anaesthetic dose reduction in a day-case setting but has a variable prolongation. Addition of epinephrine to lidocaine, procaine or bupivacaine caused a delay in discharge in a day-case setting [91, 92]. In combination with chloroprocaine in volunteers, it provided unexplained flu-like symptoms [93].

Several other additives, like neostigmine and magnesium, have been studied, but were not suitable because of side effects or prolonged time to ambulation [94–96].

2.5.4 Spinal anaesthetic technique

Several techniques are available to perform spinal anaesthesia. When isobaric solutions are injected, drug spread is affected by many factors, which mostly are patient dependent and can therefore not be influenced [78]. Urmey et al. showed that pointing the aperture of the spinal needle cephalad resulted in a more cephalad spread and faster block regression after 60 mg lidocaine in a day-case setting [97].

The availability of hyperbaric substances allows us to control intrathecal drug spread, by which a restriction of the sensory block to the surgical site can be obtained, like a saddle block or a unilateral block. Low doses of hyperbaric prilocaine or bupivacaine produce adequate analgesia limited to the sacral region for perianal surgery [98–101]. However a sitting position has to be obtained for at least 10 min or even more to prevent secondary spread of the local anaesthetic after repositioning the patient, what may result in an insufficient block [78].

Unilateral spinal blocks with a reduced local anaesthetic dose were compared to bilateral spinal anaesthesia in a day-case setting. Unilateral blocks resulted in faster recovery of sensory and motor block and more haemodynamic stability [102–105]. In a meta-analysis, Nair et al. concluded that a unilateral technique with small doses of bupivacaine (4–6 mg) is suitable for unilateral anaesthesia [52].

The duration of lateral decubitus, the amount of hip flexion and the position during injection were studied to improve the unilaterality and the success rate of the block [106, 107]. However, the idea that a spinal block is fixed after 15–30 min

is not correct, since redistribution can be seen up to 1.5 h after injection [78]. Unilateral spinal anaesthesia has been thought to reduce bladder disturbances, as only one side of bladder innervation would be impaired. Because the physiologic function of the detrusor reflex is complex, there is still controversy whether this is really true [39, 108, 109].

2.5.5 Fluid policy

Should patients receive a 'normal' or 'restricted' amount of intravenous and oral fluids? Restricting fluid can delay bladder filling and prevent urinary retention, but it can also delay voiding and discharge, when required [110–112]. Restriction of fluids might cause minor discomfort in outpatients. A fluid load can even reduce PONV after general anaesthesia [113–115]. However, if IV fluid is not restricted, the bladder may fill too early during anaesthesia, risking overdistension [35, 116, 117].

Different amounts of fluid between 750 and 1200 ml have been suggested as a maximum in order to prevent bladder retention. However in these papers, different local anaesthetics were used, fluid loads up to 4000 ml were administered, bladder volumes were not always measured, and most procedures were considered as high risk for urinary retention, such as inguinal hernia repair and urological procedures [118, 123].

There even is controversy weather fluid load always correlates with bladder filling in such a short period. When 800–1200 ml IV fluid was administered, neither correlation with bladder filling was found nor could a difference in voiding interval or urinary retention be detected compared to a restrictive regimen [37, 113, 119, 120]. One study found a correlation between bladder volume and IV fluid when more than 900 ml was administered [121]. It may be concluded that excessive volumes should be avoided, but a restrictive policy may not be necessary to prevent urinary retention.

Moreover, with the common policy to freely allow patients to drink clear fluids up to 2 h before surgery, the bladder may fill intraoperatively regardless of restricted intravenous fluid administration.

2.5.6 Discharge criteria

Discharge time is an indicator of efficiency of an ambulatory surgery unit. For safe and good clinical practice, guidelines and criteria are useful. Depending on the healthcare system, discharge criteria can vary in different countries or regions. There are several scores that can be used to test home readiness for ambulatory surgery. The modified Aldrete score [122] and the PADSS score [123] are two of them. Voiding and oral intake are parts of the PADSS and the modified Aldrete score as discharge criteria. In both scores, readiness for discharge can be achieved without voiding or oral intake, when all other variables are optimal.

Waiting for oral intake and voiding can delay discharge for both general and spinal anaesthesia. A large trial of 1184 patients showed that spinal anaesthesia was responsible for a 44 min delay in discharge for women [49, 124, 125]. There is agreement in literature that after general anaesthesia and absence of patient or surgery-related risk factors, patients can be discharged without voiding [126].

However, guidelines available are not clear weather voiding should be required after spinal anaesthesia. In the day-case and short-stay surgery guidelines from the British association of day surgery, the following guideline can be found: "Voiding is also not always required, although it is important to identify and retain patients who are at particular risk of developing later problems, such as those who have experienced prolonged instrumentation or manipulation of the bladder" [127].

The American Society of Anesthesiologists (ASA) guidelines recommend voiding before discharge only when risk factors are present as well [128]. Since spinal anaesthesia is regarded as a risk factor on its own, the guidelines are subject to different interpretation [121]. Patients operated for urogenital surgery, hernia repair, those who had experienced bladder problems in the past, patients with prostate disease and aged persons should void before discharge [35, 37, 129, 130], regardless of anaesthetic technique.

An often-quoted abstract concludes that even high-risk patients can be discharged without voiding. Although 1719 patients were included in the study, only 30 patients were identified as high risk. Those patients could not void and were discharged and followed by a home nurse. Three patients had to be catheterised at home. No bladder volumes were measured [131]. Mulroy et al. compared an accelerated protocol where low-risk patients could be discharged after neuraxial anaesthesia when measured bladder volume was below 400 ml. He concluded, after examining 46 patients who went home without voiding, that discharge after spinal anaesthesia with short-acting local anaesthetics is safe without voiding when bladder volume is below 400 ml [110].

Other authors agree that short-acting local anaesthetics should be used and bladder volumes should be monitored when patients are discharged without voiding. Some advice patients to return to the hospital when no voiding took place within 8 h of interval after discharge or until the evening of the day of surgery [3, 35, 38, 132]. After anaesthesia, overdistension of the bladder is not always clear for the patient [121]. Instructions when to return to the hospital based on measured bladder volumes seem a better option [38].

3. Conclusions

Effective anaesthesia, fast block regression and fast voiding are of uppermost importance in creating a good flow for spinal anaesthesia in day-case surgery. For this, we need a local anaesthetic with a favourable pharmacokinetic profile.

For years, lidocaine has been the drug of choice for spinal use in day-case surgery. The importance of quality of care and the demand for a fast turnover in our modern ambulatory practice has increased. Therefore, nowadays, the intrathecal use of lidocaine is criticised because of its high incidence of TNS.

Different aspects of spinal anaesthesia were studied in order to minimise side effects and to obtain short discharge times. Discharge time is mainly affected by the time to void and the occurrence of micturition problems.

Not only the local anaesthetic choice but also dose contributes to the optimal flow in a day-case setting. Other factors are also important, such as spinal anaesthetic technique, fluid policy and discharge criteria.

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