REVIEW ARTICLE

Is Spinal Anaesthesia Useful in Day Surgery?

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Introduction: An increasing number of day-case surgical patients are challenging the presently used methods of anaesthesia:. Surgical anaesthesia should be fast, reliable with rapid recovery and minimal side effects. To compete with modern ambulatory general anaesthesia, knowledge of special spinal anaesthesia techniques is essential. 'Walk-in, walk-out' spinals with an extremely low dose of lidocaine and opioids for gynecological laparoscopy created the concept of selective spinal anaesthesia.

Lidocaine was previously the agent used for short-acting spinal anaesthesia, until it was reported to cause transient neurological symptoms (TNSs) (1) and, more seriously, cauda equina syndrome (2) when used intrathecally. These neurological problems made anesthetists seek alternative suitable local-anaesthetic agents and techniques for outpatients. Two specific low-doses techniques - ***unilateral and selective spinal anaesthesia*** - have been described, although there is an overlap between the two. In some studies, the low-dose spinal-anaesthesia technique means only a reduced dose of local anaesthetic without any specific attempts to restrict the spinal spread.

Unilateral Spinal Anaesthesia: The term unilateral spinal anaesthesia is often used to mean a one-sided block with an absence of sensory and motor block on the nonoperative side (3). Enk (3) concluded the importance of 'low-dose, low-volume and low-flow' in the induction of unilateral spinal anaesthesia. The position of the patient (lateral decubitus) with respect to the baricity of the local anaesthetic is the main determinant of the final distribution of the spinal block(4). When producing a unilateral block, the maintenance of the selected position for a specified period (15-30 min) has been criticized because of possible preoperative delay. However, maintaining the lateral decubitus position for only 10 min produced a unilateral motor block in 87-100% of the patients when a low dose of hyperbaric bupivacaine (3-4 mg) was used, along with a strictly standardized injection technique that is low-flow (0.4 ml/min) steady injection with the bevel of the needle directed laterally towards the nerves involved. Before the injection a level was used to ensure the horizontal position of the vertebral column (5,6).A more predictable and reliable block with faster recovery follows after hyperbaric compared with plain solution (7). In addition, when a Whitacre needle was used, 66% of the patients developed unilateral sensory block compared with 16% of the patients on whom a Quincke needle was used(8). The distribution of hyperbaric spinal anaesthesia influences the duration of the block. With the same dose of hyperbaric bupivacaine, the spinal block lasted longer in patients with a restricted block (9). This might explain the high failure rate with spinal anaesthesia in some studies (10): if the spread is not restricted with low doses, the risk of inadequate spinal block increases. For unilateral block, reduced doses of long-acting agents, such as bupivacaine or ropivacaine, are suitable, whereas the use of short-acting (hyperbaric) lidocaine is not recommended because of the high risk of TNSs (4, 11).

Selective Spinal Anaesthesia: In selective spinal anaesthesia, minimal doses of intrathecal agents are used, so that only the nerve roots supplying a specific area, and only the modalities that need to be anaesthetized, are affected (12). Depending on the type of surgical procedure, selective spinal anaesthesia can be either bilateral or unilateral. By manipulating the position of the patient (sitting, lateral decubitus, prone) with respect to the baricity of the local anaesthetic, it is possible to influence the distribution of the spinal spread(4). Selective sensory bilateral block for ano-rectal surgery was achieved by keeping the patient in a sitting position for 10 min after a slow injection of hyperbaric bupivacaine 4-5 mg (13).For unilateral selective block not only the lateral decubitus position but also the position of the vertebral column is relevant. The 4-mg dose of hyperbaric bupivacaine injected at the L3/L4 level, with the vertebral column tilted in a head-down position for 7 min, created

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significantly higher sensory block compared with the same dose injected at L3/L4 with the vertebral column horizontal. More interestingly, the lowest sacral nerves were significantly less affected in the tilt group compared with the horizontal group, making the spinal block more segmental. Otherwise the technique in this study was equal to the unilateral spinal anaesthesia injection technique (5).To produce bilateral selective spinal anaesthesia both lidocaine and bupivacaine with and without additives have been studied, whereas for unilateral selective spinal anaesthesia only bupivacaine, alone or together with intrathecal opioids, has been used.

Choice of Local Anesthetic Agent for Different Procedures: Various procedures have specific needs for local anaesthesia, including procedures for one lower extremity, hernia repair, ano-rectal or urological surgery and gynecological laparoscopy.

Procedures for one Lower Extremity: Unilateral/ selective spinal block with bupivacaine has been widely studied, and it can be recommended for surgical procedures in one lower extremity (knee arthroscopy, foot surgery). A reliable block for surgery using a tourniquet can be produced with 4-7.5 mg of hyperbaric bupivacaine (5, 6, 9). Home-readiness was reached after 3 hours following knee arthroscopy when using spinal anaesthesia with 4 mg of bupivacaine (14) or 50 mg of lidocaine (15) or general anaesthesia maintained with desflurane (14).In the past year, ropivacaine has been one of the most studied drugs used in ambulatory spinal anaesthesia, but ropivacaine has not offered clear advantages over bupivacaine with regard to reliability, side effects or faster recovery. Using a unilateral technique, hyperbaric ropivacaine 7.5 mg and levobupivacaine 5 mg provided adequate spinal anaesthesia for knee arthroscopy, with home-readiness after 197 min (18). For other lower-extremity procedures, a suitable block was produced with ropivacaine 10 mg together with fentanyl 20 µg. The time to walking was 2.5 h whereas the ability to void occurred as late as 5.3 h after spinal anaesthesia (19). The unilateral technique was not used, and the injection flow was turned cephalad, which might explain the unexpectedly high incidence of hypotension and bradycardia (27%) in both studies (19, 20). It might be worthwhile to study whether low-dose ropivacaine (5 mg) together with intrathecal fentanyl and the unilateral technique could produce reliable, short-acting spinal anaesthesia for lower-extremity surgery.

Hernia Repair: Combining intrathecal opioids with local anesthetic, using unilateral technique and manipulating the position of the vertebral column at the time of injection to a head-down position might be beneficial for achieving a higher sensory block without the need to increase the dose of local anesthetic and thus delay home discharge (5).To produce spinal anaesthesia for ambulatory hernia repair is more complicated and has been recently criticized (21). A higher level of sensory block is required than in single-extremity procedures. Increasing the dose of long-acting local anaesthetics will, however, delay voiding and further home-readiness. Motor recovery was significantly faster after levobupivacaine and ropivacaine, whereas the time to home-readiness was similar after all agents. No case of urinary retention occurred, but the ability to void lasted up to 5 h in each group (25).

Ano-rectal or Urological Surgery and Gynecological Laparoscopy: Only a few studies have been done with a low dose of bupivacaine to produce a bilateral, short-acting block. For urological surgery, bupivacaine 5 mg with fentanyl 25 µg was compared with total intravenous anaesthesia (TIVA) with propofol and remifentanil. Walking was reached equally fast after surgery (80 min), but the TIVA patients were home-ready 1 h earlier than the spinal anaesthesia group. Voiding was, however, required only in the spinal-anaesthesia group. Patient satisfaction was significantly lower in the TIVA group because of the pain experienced postoperatively (21). A 'saddle block' was produced for day-case prostate Brach therapy with 5 mg of hyperbaric bupivacaine alone, or with only a 2.5 mg dose of bupivacaine together with 25 µg of fentanyl. Both doses provided a suitable block for the procedure, although in the bupivacaine/fentanyl group 43% of the patients needed intravenous midazolam. Voiding and home discharge were achieved 40 min faster in the combination group (22). Interesting 'walk-in, walk-out' spinal anaesthesia for laparoscopy has been produced with extremely low doses of lidocaine (10-20 mg) together with opioids (fentanyl 25 µg or sufentanil 10 µg) (14). Whether this walking spinal technique can be taken into wider practice remains to be seen.

Choice of Adjuncts: For outpatients lipophilic opioids and low-dose clonidine can be used as intrathecal adjuncts, whereas several other agents studied (adrenaline, neostigmine, morphine) are not suitable because they cause delayed home discharge and/or side effects. Low doses of lipophilic intrathecal opioids

improve the quality of anaesthesia (10) without delaying home discharge significantly (12,15). Compared with morphine, small doses of lipophilic opioids have a shorter duration of action and a low risk of respiratory depression. Fentanyl (10-25 µg) or sufentanil (10 µg) have been used together successfully with different local anaesthetics.

The Future: 2-chloroprocaine?: 2-CP has been reintroduced for spinal anaesthesia recently and a preservative-free solution of chloroprocaine is available for off-label use (230. With volunteers, a low-dose of lidocaine or 2-CP (40 mg) produced equal sensory block and tourniquet tolerance for approximately 40 min, whereas 30-min faster ambulation sensory block and ability to walk by 50 min, compared with 2-CP 30 mg (24). Compared with bupivacaine 7.5 mg, chloroprocaine 40 mg produced an equal sensory block and tourniquet tolerance, but 80-min faster home-readiness (25) respectively. All in all, when using 2-CP 30-40 mg alone or with adjunct, the time to reach home-readiness (100-130 min) is suitable for day surgery. The results of these preclinical studies make low-dose 2-CP an interesting drug for producing a bilateral block, but more data are needed before it can be taken safely into clinical practice.

Benefits of Unilateral or Selective Spinal Anaesthesia: With adequate doses of local anaesthetic agents, the time to home-readiness after unilateral spinal anaesthesia or selective spinal anaesthesia (5, 6, 14) with bupivacaine, or after a low-dose spinal anaesthetic with lidocaine and fentanyl or sufentanil has been equal to that for general anaesthesia maintained with propofol or desflurane (14). However, this finding was not confirmed in a recent meta-analysis (26). On the contrary, a significant delay in home discharge was associated with spinal anaesthesia compared with general anaesthesia, despite the excellent early recovery following spinal anaesthesia. Yet this result can be criticized because of the heterogeneous data with respect to the type of surgery, the dose of local anaesthetic agent (4-11.25 mg of bupivacaine), the spinal anaesthesia technique and especially the varying home-discharge criteria used. The home-discharge criteria have been changed in this respect, and the requirement of voiding before discharge after low-dose spinal anaesthesia should be mandatory only in high-risk patients (hernia or ano-rectal surgery, history of retention) when short-acting agents or bupivacaine <7 mg are used .Pain can delay discharge home or even cause an unplanned hospital admission after ambulatory surgery (18). A recent meta-analysis showed significantly lower visual analogue scale (VAS) pain scores and a reduced need for postoperative analgesics when surgery was performed under spinal anaesthesia compared with general anaesthesia (26). The cardiovascular stability following unilateral spinal anaesthesia is certainly one of the most important benefits, especially in patients with heart disease. Hypotension may develop in 30% of patients with bilateral spinal anaesthesia, even with intermediate doses (17,18), compared to 0-6% with unilateral or selective spinal anaesthesia (6, 14).The most frequent complication following general anaesthesia is postoperative nausea and vomiting (PONV) , but it is associated with spinal anaesthesia as well. With a low-dose local anesthetic alone the risk is minimal 914), whereas intrathecal opioids seem to induce PONV dose-dependently. As many as 30% of patients developed nausea after intrathecal fentanyl 20-25 µg or sufentanil 10 µg (11, 12), compared with 3-7% after intrathecal fentanyl =15 µg .All in all, the reasons for the high patient satisfaction levels (90-99%) after unilateral or selective spinal anaesthesia have been as follows: good pain relief, decreased incidence of PONV, alertness, rapid recovery and maintenance of autonomy after the spinal block (5, 6, 14).

Disadvantages of Unilateral or Selective Spinal Anaesthesia: The incidence of postdural puncture headache can be significantly reduced by choosing a small-gauge (G27) pencil-point (Whitacre) spinal needle instead of a Quincke type of cutting needle of the same size. The incidence of TNSs has been highest after lidocaine spinal anaesthesia (37%) and in patients undergoing knee arthroscopy (22%) or surgery in the lithotomy position (36%) (11), whereas after bupivacaine or ropivacaine it has been as low as 0-3%(6).TNSs have developed most often with lidocaine doses over 50 mg (15), so this dose should not be exceeded. With low-dose unilateral spinal anaesthesia 0-6% of spinal blocks have failed when bupivacaine 4-8 mg has been administered (6, 14), but a failure rate as high as 24% has been reported without a specific technique. This high rate was reduced to 0% when 10 µg of Fentanyl was combined with bupivacaine 5 mg (10). On the other hand, pruritus develops in 60-100% of the patients receiving opioids as an intrathecal adjunct (6, 10,17).

Conclusion: Spinal anaesthesia is a suitable anesthetic method for day surgery, but a specific technique and an adequate local anesthetic and dose should be used. For single-lower-extremity procedures, hyperbaric bupivacaine <7 mg produces a reliable unilateral block with a reasonable time to home-readiness and a low incidence of side effects. Ropivacaine has not shown benefits over bupivacaine with regard to faster recovery. When lidocaine is administered, the 50-mg dose should not be exceeded and a restricted block should be avoided. Low-dose 2-CP may be the local anaesthetic for short-acting bilateral procedures in the future, but its safety has not yet been proven.

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