

Continuous spinal analgesia: a forgotten, safe and very efficient method for old patients”.

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HISTORY AND INTRODUCTION

The technique of continuous spinal is an old one. Dean, in 1907 introduced the intermittent injection of stovaine, through a needle into the subarachnoid space (1). This pioneer work was forgotten and it was only in 1939 that Lemmon published his first 200 cases using a silver flexible needle, associated with a special mattress (2,3). From them on, it was Tuohy, who exchanged the needle for an urethral catheter in 1945, threading it through a 15G canulae with a Huber point, since then known as the “Tuohy needle”(4,5). From then on the canulas got thinner and so did the catheters: Hingson and Southworth with 16G Tuohy needle and a polyethylene tubing simplified the procedure (6) but it was Giufrida and Bizarri that proposed a smaller bore - 21G Tuohy needle associated with a suitable plastic catheter, that advanced the technique still further, advising it for poor risk cases and in Obstetrics(7). Fortuna, in Brazil, using the procedure mostly for sick and old patients, showed that the method was a practical and safe one (8,9,10,11)

In the nineties, the appearance of microcatheters (12) produced a series on neurologic disasters that practically stopped the use of CSA in the United States and most of the world. High concentration of the anesthetic at the lumbo-sacral region, bad dispersion of the agent and the use of 5% lidocaine were all associated with the problem (13, 14).

Nowadays, large series are appearing in Spain (Aliaga,Genové, De Andrés) (15,16) Germany, Mollman (17) and Brazil, Fortuna(10), showing that this method should be rediscovered, for poor risk patients in the old age bracket. The same usual plastic catheters that come inside an epidural kit

are quite adequate for CSA and time has shown that they are safe (10, 18,19)).

Brown, in 1952 reported 600 cases of CSA in poor risk patients (18) and Underwood in 1968 also related a large number (19). All of them stressed the safety and the good results obtained with CSA.

In Bern, Derron (20), during a European Reg. Anesth Soc. Meeting, in 1990, related 2.000 cases, where the catheter was left for 24 to 48 hours for postoperative pain control in most of them, with excellent results.

We have been using the CSA everyday in our department, since the late fifties and now we can count on over 1.300 patients handled this way.

This lecture will be based on the anesthetic world literature and in our experience that really started in 1954, in Buenos Aires. It was there where we learned this technique from Dr. Italo Nunziata, an outstanding Argentinean pioneer in Anesthesia.

AGENTS AND TECHNIQUE

It seems that the best drug for this procedure is isobaric bupivacaine, 0,5, without epinephrine. Hyperbaric solutions are chosen when we want to control and limit the spread of the analgesia by changing the patient decubitus (21,22).

Previous, we have used lidocaine a lot, in a 2 or 3,3% solution with glucose without seeing any transient or permanent nerve damage. Today, we gave up its use, due to the large numbers of reported patients who presented short lasting neurological sequela after spinal blocks with this agent. They were described with solutions of different strenghts, from 2 to 5% (23, 24,25)

Personally we have never noticed this transient radicular syndrome in any or our cases many others have. Due to these reports, spinal solutions of lidocaine should now be considered an exception for subarachnoid blocks, continuous or otherwise (23,24,25).

The equipment for CSA should always be disposable. Our preferred needle is a 19 or 18G Tuohy with a plastic catheter made from nylon, vinyl or equivalent material (26).

We follow two golden rules in regional anesthesia. The first is that all drugs that go into the spine must be fully sterilized, inside and outside the ampoules or vials (26,27). Ethylene oxide bags and plastic bubbles are suitable for all the preparations we use. Autoclaving can be also applied for the local anesthetics but not for morphine or similar drugs. For those, if they do not come sterilized in plastic containers by the manufacturer, we send them to a private laboratory, where they do it for us (27,28).

The second and also a very important measure, is that nothing can be injected into a patient without a second person present confirms the name of the drug, its dosages and its validity (26,28).

Too many disasters have been caused by the inadvertent swapping of drugs or syringes. To quote only a few, all described in the literature, there have been several cases of mistaking galamine for procaine and lidocaine, potassium chloride for CIna, dipirona for lidocaine and so on (26,28,29).

As done for all regional anesthetic procedures, one or two good venous sites, are secured, with 18 to 16G plastic needles connected to an IV solution. The EKG sensors, pulse oximeter and the blood pressure apparatus are connected and all the data obtained is registered in the anesthetic chart, to serve as a base line.

An anesthetic machine is always at hand, tested and ready. Laryngoscopes, masks, endotracheal tubes, LM masks and airways should all be available, same as it were for general anesthesia. Syringes, containing atropine, phenylephrine, metaraminol and ephedrine are prepared and well marked. Thiopental, midazolam, ketamine and fentanyl are also available.

The lumbar puncture is preferably performed in the lateral position, after a careful local infiltration of the L3 to S1 chosen interspinal space with 0,5% lidocaine, 8 to 10 ml without epinephrine. The skin wheal is done with a short 30G tuberculin

needle followed by deeper injections with a longer one - 4 to 5 cm, 22 or 25G.

The 18G Tuohy needle is introduced with its point oriented cephalad or caudad, depending in which direction we intend to orient the catheter. The epidural space is identified and the canula is pushed a few millimeters forward, until the dura is pierced. This is confirmed by the appearance of spinal fluid at the hub on removal of the stylet.

At this moment, the catheter is threaded into the needle as fast as possible, to diminish the loss of fluid. It is inserted 2 to 3 cm inside the subarachnoid space and usually some transitory paresthesias are referred by the patient during this maneuver.

If the passage through the point of the Tuohy needle is difficult, it is usually due to the catheter impacting on the anterior wall. Backing out the needle for 2 to 3 mm is enough to overcome this difficulty.

Fluid should come out easily through the catheter. It is then closed, either by a stopcock or an obturator, with or without a filter. The whole thing is covered by a plastic sheet, including a 5 ml syringe containing the chosen spinal anesthetic. Injections are made wearing sterile gloves.

The patient is turned on his back and if this is the desired surgical position, the first dose of 0,5 isobaric bupivacaine, 0,5 mg (1 ml) is injected. The patient is observed for a few minutes, to check the level reached by the analgesia and to detect any changes on the vital signs.

For younger patients, where post spinal headaches are a real problems, there is a new system, the "spinocath" put on the market by the Lab. Braun. It is a somewhat complicated unit, where the epidural space is reached first through an 18G Crawford epidural canula. Next, a Quincke point needle, 27 or 29G is inserted through it into the subarachnoid compartment. Once liquid flows, a metallic guide goes in with the catheter on the outside, through the hole made into the dura. The catheter stays on and the wire is extracted (17,30).

In our view, there is a very good chance, of at least 2%, in perforating the dura with the Crawford needle. This would increase greatly the chances of a severe post operative headache afterwards if the patient is under 60.

More experience is needed with this device. To us, it seems unhandy, expensive and not “user-friendly”. Time will tell (30.)

MAINTENANCE OF THE CSA

If the patient is to be turned on the lateral or the prone position for the programmed surgery, no local anesthetic is injected through the spinal catheter. If the movement will be painful or uncomfortable for the individual, 10 to 15 mg of ketamine, with or without 0,5 to 1 mg of midazolam are applied IV.

It may be risky to turn someone with a sympathetic block present. Deep hypotension and severe bradycardia may result which can progress to cardiac arrest if not correct immediately (31). The best option is only to start the block after the individual is placed on the table at the position demanded for the surgical procedure.

If the necessary analgesia level has not been reached after the initial 5 mg dose of bupivacaine, 2,5 mg more are injected, with intervals up to 3 minutes, until the block reaches high enough to allow the intervention to proceed. Testing is done by a cold liquid, touch or lack of muscular response to a gentle squeeze (32,33,34).

The great majority of these patients do not wish to stay awake. He is then kept quiet and sedated by small I.V. doses of fentanyl (10 to 25 micrograms) or midazolam (0,25 to 0,5 mg). This combination is adequate for orthopedic surgery lasting less than three hours. It is mandatory to use always the inhalation of O₂ by plastic mask or nasal catheter every time this kind of sedation is required (35).

For intra-abdominal surgery, reaching above T10, it is better to complement the spinal analgesia with some form of inhalation anesthesia – narcoanalgesia, associated with a laryngeal mask or an endotracheal tube. Ventilation can be assisted or controlled,

facilitated by the use of small amounts of muscle relaxants (rocuronium, cisacurium) or fentanyl. The same goes for long vascular, urological or GI procedures (36).

Bupivacaine, 2,5 mg ,is added when there are evident signs of discomfort, pain or poor muscular relaxation. If necessary, a hyperbaric solution can be used, associated with proclive or declive of the operating table, to extend the block in the desired direction, higher or lower (21,22).

Depending on the patient's physical conditions, lowering of the systolic blood pressure up to 30% is tolerated and it is even helpful to decrease blood losses.

Bradycardia below 50 b/min should be treated. The important thing is to watch the curve that shows the tendency of heart slowing. If it is accompanied by hypotension, the drug to use is 10 to 20 mg of ephedrine IV. If not, atropine, 0,25 to 0,5 mg is the indicated agent (31).

Undesired hypotension, especially if severe and associated with bradycardia, it is controlled with ephedrine or metaraminol. When tachycardia is the issue, phenylephrine is used (26).

These drugs are applied by bolus or by intravenous drip: 10 mg of metaraminol, 10 mg of phenylephrine or 50 mg of ephedrine dissolved in 250 ml of the chosen IV solution. If single shots are preferred, 0,1 to 0,5 mg of metaraminol or phenylephrine are indicated. For ephedrine the dose it 5 to 10 mg. All these drugs may be repeated, if necessary, depending on the patient's response.

The sooner the treatment is started, the better. The moment the monitor curves shows a hard tendency for deviation from normal levels of pressure or heart frequency, preventive measures should be taken.

When the CSA is indicated for a high risk patient, with full stomach or respiratory problems, protecting the airway is achieved before starting the block. On several instances we made awake intubations under topical 4% lidocaine plus a transtracheal injection of 4 ml of a 2% solution. It helps to give 25 to 50

micrograms of fentanyl before the spray, associate it with a good talk to calm the patient and a simultaneous injection of 0,5 to 1 mg of midazolam. After the spray and transtracheal application of the local anesthetic, an oxygen mask is placed on the patient and a one should wait 5 to 10 minutes before the intubation maneuvers are attempted.(36).

Once the endotracheal tube is in, the spinal block is performed, with the subject placed in the lateral position. Sometimes it helps to give a further dose of fentanyl or start inhalation anesthesia with the preferred halogenated agent during the puncture. With us our preference is either enflurane or isoflurane.

At the end of the procedure, if the patient is ventilating well on his own, the tube is taken out. The laryngeal-tracheal reflexes must be evident and the patient should be able to obey commands.

Blood and lost fluids during the surgery, are replaced in the usual way. However, it should be kept in mind that the spinal block causes vasodilatation, and that is the main cause of hypotension. The basic treatment of it is with vasopressors, with quick infusion of liquids being the second best.

Normally the patients are fully awake and pain free when the surgery is over. If the hospital has a good PACU unit and there are well trained and reliable people there, post operative pain control can be considered, either with opioids, morphinomimetics or local anesthetics, applied through well calibrated pumps or repeated single shots (20, 37).

INDICATION FOR CSA.

By the same way token that epidurals are the preferred method of central blocks for young patients, spinals are the ones to be chosen for people over 60.

It is a suitable technique for poor risk individuals, scheduled for long and short stressful interventions. Procedures taking place below the T4 level: stomach, intestines, spleen, liver, gyn, urological or vascular can be well managed with CSA.

For most of these cases a combination of light narcosis, a method we have called “narcoanalgesia”, is a must. The general anesthetic gives the necessary hypnosis and the spinal block assures the demanded analgesia, muscular relaxation and absence from noceptive reflexes.

Perhaps the most popular use CSA is for perineum and lower limbs, for hip and femur prosthesis. Our older patient was 99 years old and did very well on the pre and postoperative period.

The fractionated injections permitted by the CSA allows for an adequate titration of the anesthetic agent which produces the expected block for the planned intervention together with freedom of time limit. This avoids problems with the over and under dosage together with eventual short lasting analgesia, which can happen with one-shot spinals.

The basic indications for CSA can be resumed below.

- 1) 1) Patients over 60, who only rarely develops post spinal headaches. In the 1.300 cases we have done, mostly of them dealing with geriatric patients, we never observed a post spinal headache that needed blood patch for its control in this age bracket. A few happened but were of mild or moderate intensity.**
- 2) 2) High risk cases, where the block must be tailor made, either for the surgery duration or to use the least amount of local anesthetic needed to produce an efficient and safe analgesia. Sometimes 5 mg of bupivacaine can be enough for 5 hours surgery, reaching supra-umbelical levels.
In single shot spinals, sometimes even 20 mg of isobaric bupicacaine is not enough in extension and block duration. This problem is solved by a CSA which has this big advantage: “the most with the less” and “for how long as it takes”,.**
- 3) 3) Patients with severe metabolic diseases that are prone to develop acid-base unbalance under pure general anesthesia with muscle relaxants, specially in the postoperative period.**

- 4) 4) **Individuals with borderline cerebral perfusion who tends to present confusion and serious disorientation after pure general anesthesia. The frequency of this sequela is less when CSA is used.**

CONTRAINDICATIONS FOR CSA

- 1) 1) **The main one is refusal of the patient in agreeing with the proposed anesthesia and to sign the consent form. Legally and ethically any medical procedure demands approval by the patient or the person responsible for him or her (minors, mental incompetents).**
- 2) 2) **Lack of experience and training in CSA.**
- 3) 3) **Diseases of the Central Nervous System**
- 4) 4) **Age can be also a relative contraindication, as in young patients the incidence of post spinal puncture headaches oscillates between 10 and 20%, depending on the needle size used for the puncture.**
- 5) 5) **Cardio-vascular instability (shock, hypovolemia, dehydration).**
- 6) 6) **Chronic back pain (risk of exacerbation, possible malpractice allegations later).**
- 7) 7) **Skin and tissue infection at the puncture level.**
- 8) 8) **Abnormality of blood clotting mechanisms. The use of anticoagulant drugs demands important precautions: a) Puncture should be done one hour before subcutaneous heparin is used; b) the catheter is removed one hour before the next heparin dose or two to four hours after the last one; c) With low molecular weight heparin, the application must be suspended 10 to 12 hours before the spinal block and the catheter is only be removed after the same period of time has passed (38,39,40).**
- 9) 9) **Gross spinal deviations (relative).**

- 10) 10) **Poor aseptic technique. Local anesthetics ampoules not sterilized in the inside and outside.**
- 11) **Lack of standard resuscitation equipment.**

ADVANTAGES OF CSA.

The main one is that CSA is tailored to the patient's needs, taking in account the duration of the procedure and the extension of the block.

We can also add:

- 1) 1) **Decrease of the surgical stress- Anoci-association (Crile 1914), Stress-free anesthesia Kehlet, H 1982) (41).**
- 2) 2) **Diminished surgical bleeding due to the sympathetic block (42).**
- 3) 3) **Associated with narcoanalgesia, ensure airway protection and effective ventilation (36) Simple sedation can also be used mitigate the discomfort with the position on the surgical table and fatigue during the procedure. However, one must be always careful of the "sedation trap": respiratory depression or airway obstruction. In our view, if in doubt, narcoanalgesia is the better option (36).**
- 4) 4) **Absence of toxic reactions to the local anesthetic agent (low dose).**
- 5) 5) **It avoids the mandatory use of muscular relaxation and its needed reversion (Aitkenhead, 1982)**
- 6) 6) **Awake and fast recovery, pain free.**
- 7) 7) **Reduction of thromboembolism (Modig 1982) (42).**
- 8) 8) **Conscience present, when desirable.**
- 9) 9) **Possibility of postoperative analgesia, with opioids or local anesthetics. Bolus, pumps and association with bacterial filters (20,43).**
- 10) 10) **Early ambulation and less incidence of embolism (42).**

DISADVANTAGES OF CSA.

- 1) 1) **Potential hazards of severe hypotension and bradycardia.**
- 2) 2) **Post spinal puncture headaches (young patients, 10 to 20%).(43).**
- 3) 3) **Potential hazards of neurological sequelae (26,28,29).**
- 4) 4) **Possibility of infections (29).**
- 5) 5) **More time consuming, especially if combined with narcoanalgesia.**
- 6) 6) **Potential hazards of intra or extradural bleeding in patients receiving anti-coagulant medication. Special attention to heparins of low molecular weight (38,39,40).**
- 7) 7) **Demands association with narcoanalgesia, mainly for middle or upper level intra-abdominal procedures (37).**

COMPLICATIONS OF CSA

- 1) 1) **Possibility of neurological sequelae (rare) (29).**
- 2) 2) **Risk of meningeal infections**
- 3) 3) **Post spinal headaches (very unusual in older patients) (43).**
- 4) 4) **Lombalgia: mostly due to the position on the table. Can be almost avoided by the use of lumbar air cushion or adequate back pillow.**
- 5) 5) **Cauda equina syndrome: several cases appeared after the introduction of the new “micro catheters”, which made the American FDA order them out of the market. It seems the cause of those catastrophes were bad positioning of the catheter point (in the sacral region) associated with faulty distribution of the local anesthetic agent, which reaches high concentration near those roots. It does not seem to happen with the usual epidural catheters 20 or 22G (12,13,14).**
- 6) 6) **Extra or intradural hematomas, causing paralysis. Derron, after a series of 2.000 cases of CSA without neurological complications, keeping the catheter for postoperative pain control, described a case where the analgesia was not interrupted at the end of the surgery. For**

this reason, the hematoma was not detected on time and the patient become paraplegic (20,29).

RESULTS

Our results in over 1.300 cases of CSA showed that it is a safe method, if there is care in the indication and on the management of the patient. On the table that accompanies this text, we show the analysis of our first 820 cases. 9% were managed with 0,5% tetracaine, 90% with 2 to 3,3% heavy lidocaine and 1% with 0,5% isobaric bupivacaine.

From 1.990 on, all the resulting cases were done with 0,5% isobaric bupivacaine, which seems to be the actually the best drug for CSA use.

We had two instances of failure, due to the agent. One with tetracaine and the other, with bupivacaine. Exchanging both of the products for lidocaine, resulted in the expected block.

We are forced to conclude that, in some rare instances, a local agent injected into the subarachnoid space does not act, either due to possible changes with the drug or some physical-chemical properties of the spinal fluid affecting the agent. On CSA, this does not represent any difficulty, because it is very easy to change the anesthetic.

The intercurrences, during the anesthesia, were the expected ones; 54% had drops in systolic pressures that demanded the use of vasopressors. Two per cent presented bradycardia, with a frequency below 50 bpm.

SUMMARY AND CONCLUSIONS

CSA is a method of anesthesia that deserves to be more frequently used, for high or moderate risk geriatric patients,

Its main indication, when used as a sole technique, is for surgery below T10, especially in orthopedics (hip nailing, hip replacement), lower limbs, vascular, GYN and urological surgery. Poor risk patients, ASA III or IV benefit from the

small amount of anesthetic agent used, the titration of its expected effect and absence of a time limit. The anesthesia is made to last long enough to allow any kind of procedure below T4, with the advantage that its administration can be continued to control post operative pain and discomfort.

In this is done, it is important that the patient should recover from the block before further injections are made, in order to avoid masquerading a rare and eventual intra or extradural hematoma compressing the cord that may have been produced by the spinal puncture..

To achieve dependable and optimal results, it demands a careful technique, adequate cardiovascular monitoring, constant and armed vigilance of the airway and ventilation besides a good experience of the anesthesiologist with central blocks. If available, automatic blood pressure devices are a good substitute for the ordinary insufflation manual arm cuff.

Cardioscopes and oximeters must always be used. O₂ administration is another adjunct that should be provided to all patients, either by facial mask or nasal catheter.

Blood pressure should be kept at safe levels. Vasopressors must be used earlier, at the moment that a trend for falling the BP is noticed. At this point, they are fully effective in controlling the vasoplegia produced by the sympathetic block. Metaraminol, Ephedrine and Phenylephrine are the preferred agents, either by bolus injection or by drip, with or without a delivery pump.

The same goes for heart rate. Bradycardia below 50 b/min is corrected by atropine (without hypotension also present) or by ephedrine (associated with hypotension).

Of course CSA can also be used for young patients but there is always a high incidence, 10 to 20% of post spinal headaches in this age bracket. The idea that the catheter in place would somewhat close the dural hole earlier than the

one produced by the needle, does not seem to hold true. (43,44).

As the minimum necessary effective dose is reached by gradual small increments of the anesthetic drug, it is easy to evaluate the expected result. The response is much faster than with epidurals. With those, this kind of fine-tuning would be impossible. Muscle relaxation and analgesia obtained with CSA are better and there is no danger of toxic reactions due to inadvertent intra-vascular injections.

As a final comment, we can say that dealing with central blocks, epidurals are favored for young or middle aged patients where spinals, single or continuous the elected anesthetic method for people over 60 years old, every time a central block is considered to be the method indicated for the planned procedure.

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