A Brief Insight about Continuous Spinal Anaesthesia

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Abstract

Continuous Spinal anaesthesia (CSA) is the technique of producing and maintaining Spinal anaesthesia with small doses of local anaesthetic which are injected repeatedly as required into the Subarachnoid space via an indwelling catheter.Continuous spinal anaesthesia (CSA) is an infrequently used anaesthetic technique, where an intrathecal catheter (ITC) allows titrated injection of local anaesthetic into the intrathecal space to produce a subarachnoid block. Unlike single dose spinal anaesthesia (SDSA) where a fixed larger dose can result in an unpredictable block height and haemodynamic instability, titratable CSA allows lower doses to be used and the ability to extend the duration of anaesthesia if required. Continuous Spinal anaesthesia (CSA) as an alternative to general anaesthesia for many surgical procedures is a method almost as old as the technique of Spinal anaesthesia itself. Perceived advantages of this technique include an unequivocal endpoint of catheter placement in the Subarachnoid space because CSF can be aspirated through the catheter, with assumed less incidence of PDPH, It is believed that CSF does not leak because the hole made in the Dura by the Quincke needle is sealed by the wider bore catheter

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Introduction:

Continuous Spinal anaesthesia (CSA) is the technique of producing and maintaining Spinal anaesthesia with small doses of local anaesthetic which are injected repeatedly as required into the Subarachnoid space via an indwelling catheter [1].

Continuous Spinal anaesthesia (CSA) as an alternative to general anaesthesia for many surgical procedures is a method almost as old as the technique of Spinal anaesthesia itself, **Augustus Bier**

described the first Spinal anaesthetic with Cocaine in 1899 and in 1906. **Henry Percy Dean** described a technique in which Spinal anaesthesia could be extended, he was aware that Ester local anaesthetic agents did not usually last long, that the dose requirement of local anaesthetic agent varied in each patient and that the duration of surgery could be different.To overcome this, he considered giving another injection during the surgical procedure and he invented the "exploring needle" which can be left in situ during the operation so that at any moment another dose can be injected without moving the patient beyond a slight degree. however, the technique did not become accepted into practice and his efforts to promote it were probably limited due to his ill health and his retirement in 1933 **[1]**.

CSA was rediscovered in 1940 and went through a "stuttering evolution" through the 20th century by **Tobias et al[2]**, who gave a fascinating account of this technique. The CSA technique evolved further in the 1990s when Spinal micro-catheters were introduced but the technique was surrounded by controversy due to assumed occurrence of Cauda-Equina syndrome leading to the banning of Spinal micro-catheters by the Federal Drug Administration (FDA) in the USA, But **Denny[3]** questioned the etiology of Cauda-Equina syndrome and stated that "For a number of years and on several occasions CSA has prevented patients from needing postoperative ventilation and it would be unfortunate if this extremely useful technique was abandoned due to its inappropriate application", While in the same time, CSA continued to be used in clinical practice outside of the USA **[4]**.

Types of catheters:

There are many types of intrathecal catheters that can be used with different techniques of insertion, advantages and disadvanatages. Also there are possible complications to the technique which must be understood and managed, and contraindications with which the technique should be avoided or modified **[4]**.

1-Catheter-Over-The Needle Type: Represented by the B Braun SPINOCATH®, features a catheter-over-needle design where the catheter is positioned over the Spinal needle. Perceived advantages of this kit is that CSF does not leak because the hole made in the Dura by the Spinal needle is sealed by the wider bore catheter resulting in less incidence of PDPH, also there is an unequivocal endpoint of catheter placement in the subarachnoid space because CSF can be aspirated through the catheter **[5].**

It consists of a standard 27 or 29G Quincke Spinal needle, a 22 or 24G tapered catheter tip that gently dilates the Dura and gives excellent tactile feedback and thus the first identification of successful Dural puncture with a side hole that assures aspiration through a second opening **[5].**

The Perifix® catheter material is characterized by its superior handling characteristics, easy injection, aspiration and barbotage, good distribution of anaesthetic and it is also suitable for syringe pumps (such as Perfusor®), The Quincke needle has a fluid exit side hole that lies within

the catheter, and in addition the needle is connected to a smooth LASER welded pull wire that allows its safe and easy removal after correct positioning of the catheter, The kit also contains an 18G Epidural needle used to access the Epidural **[5].**

Figure 1: catheter over needle kit **[6].**

The technique of insertionconsists of identifying the Epidural space by the loss-of-resistance technique using the Epidural needle, then passing the Spinal needle (with the catheter mounted on it) through the Epidural needle in a manner that would be analogous to the needle through needle technique used for combined Spinal Epidural anaesthesia**.** Once the Dura is punctured, the needle is advanced a little. CSF is detected within the catheter, as it emerges from the fluid exit side hole in the Quincke needle, and the braided wire is then withdrawn which also pulls back the Quincke needle, leaving the catheter within the intrathecal compartment which simultaneously seals the hole in the Dura. The Epidural needle is then withdrawn and the catheter is connected to a filter via a connector and is then ready for use **[5].**

Perceived advantages of this technique include an unequivocal endpoint of catheter placement in the Subarachnoid space because CSF can be aspirated through the catheter, with assumed less incidence of PDPH, It is believed that CSF does not leak because the hole made in the Dura by the Quincke needle is sealed by the wider bore catheter **[5].**

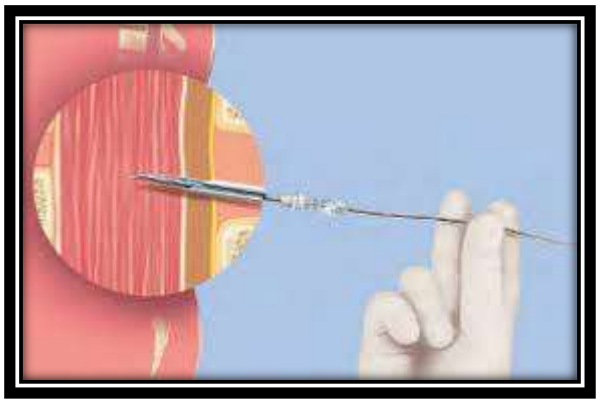

Figure 2: Passing the spinal needle through the dura **[6].**

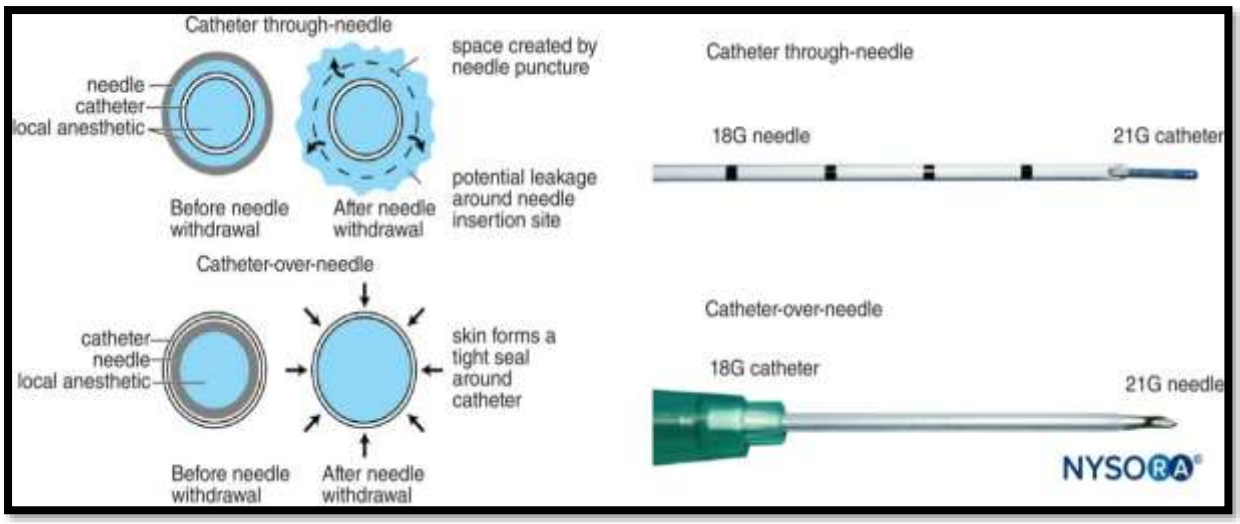

Figure 3: Comparison of CSF leakage in catheter over needle and catheter through needle **[7].**

2- Catheter-Through-The Needle Type: These catheters are available in varying sizes ranging from 25G (macro-catheter) to 32G (micro-catheter).

A-Standard Epidural catheter set

A standard Epidural catheter can be used for continuous Spinal anaesthesia (standard Epidural catheters range from 18 to 20G macro-catheter inserted through from 16 to 18G Tuohy Epidural needle, The catheter is inserted into the subarachnoid space after a deliberate Dural puncture with an Epidural needle. These sets are widely available and little additional training is required for those familiar with inserting a normal Epidural catheter **[8].**

However, performing a deliberate Dural puncture with an Epidural needle may be difficult for some experienced clinicians, also Post Dural Puncture Headache (PDPH) is a risk as we will see later. It should be put in mind that if this catheter type is left in situ for post operative pain relief then there is potential for error, as an Epidural dose of drug could be administered intrathecally **[8].**

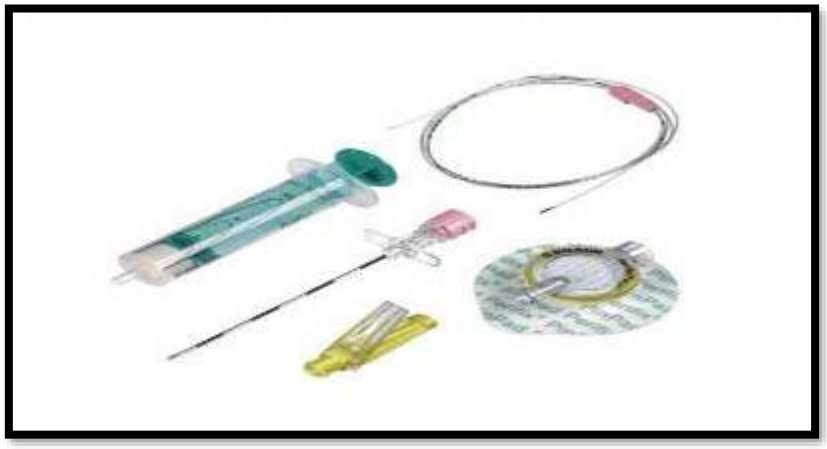

Figure (4): Standard Epidural Set **[6].**

B-Smiths Portex®

It consists of a 19G Tuohy needle with a 23G Crawford Spinal needle with optimized 30 degree angle of bevel, the needle bevel heel and sides blunted to minimize the risk of potential catheter shearing. Graduated markings permit accurate catheter positioning. It contains 28G micro-catheter with Polytetrafluoroethylene coated stylet that aids easy withdrawal from catheter **[8].**

C-Kendall CoSpan®

It consists of a 28G micro-catheter and 22G Quincke needle **[8].**

Those last two sets are considered micro-catheters, they may be more difficult to insert and they kink easily if force is exerted during insertion, Once inserted, it is virtually impossible to aspirate CSF from them. However, it is observed that if sufficient time is allowed, one may occasionally see a drop of CSF emerge from the end of the catheter, Although CSF emergence is an unequivocal end point of a Spinal catheter placement, in routine clinical practice this would be an impractical method of confirming catheter location **[9]**.

In a study made to compare between the Portex® system (micro-catheter) and the Spinocath® system regarding PDPH in young adults no significant difference could be demonstrated between the two systems with different techniques of Dural perforation. However, analysis revealed a significantly shorter duration and reduced severity of headache in the over-needle group **[10]**.

Advantages of CSA

It was found to be specially beneficial in patients with Aortic stenosis, Eisenmenger's syndrome, Cardiomyopathy, Scoliosis, Ankylosing Spondilitis, Orthopedic elderly patients, Urological elderly patients undergoing endoscopic procedures, Patients undergoing vascular interventions in the lower half of the body, Patients undergoing interventions for repair of Aortic aneurysms, General surgical patients undergoing major pelvi-abdominal surgeries, Morbidly obese patients **[11]**.

Contraindications for CSA

The Contraindications for continuous Spinal anaesthesia (CSA) are generally those of neuraxial anaesthesia as whole with some differences:

- **Absolute Contraindications:**

Patient refusal, bleeding diathesis, elevated intracranial pressure and infection at the site of injection. Although no preoperative screening tests are required for healthy patients undergoing neuraxial blockade, coagulation studies and platelet count should be checked when the clinical history suggests the possibility of a bleeding diathesis. CSA differs in that unlike other types of

neuraxial blocks, severe hypovolemia, severe stenotic valvular heart disease or ventricular outflow obstruction are not considered a contraindication for CSA **[12]**.

- **Relative Contraindications:**

Clinical findings in the back, psychosis, or emotional instability, pre-existing neurological deficits or demyelinating diseases, Sepsis or Bacteremia**[12].**

Complications of CSA

The complications of CSA include those generally associated with any neuraxial block and complications related to the intrathecal catheter itself **[13].**

General Complications: discomfort, itching, nausea and vomiting (PONV), hypotension, Post-Dural Puncture Headache (PDPH), infective complications, aseptic meningitis, Spinal hematoma, Spinal cord or nerve root injury **[13].**

Catheter-Related Complications: Cauda Equina syndrome, intrathecal Granuloma, catheter migration, CSF leak, Spinal Myoclonus, Traumatic Syrinx **[13].**

- **Post-Dural Puncture Headache (PDPH):**

In CSA, the risk of PDPH remains controversial, ranging from very low to over 30%. And to reduce the risk of PDPH in CSA, small-gauge Spinal catheter systems with different techniques of Dural perforation have been developed **[58]**. 4 as the over-needle group which showed a significantly shorter duration of PDPH and lower maximum pain intensity than the through-needle group concluding the potential benefit of the catheter over-needle technique for the reduction of the duration and intensity of PDPH **[15]**.

- **Catheter-Related Complications:**

Cauda Equina Syndrome (CES):a few cases of sudden onset of CES following continuous Spinal anaesthesia with 5% Hyperbaric Lidocaine through micro-catheters have been reported leading to the banning of using Spinal micro-catheters (not the CSA technique itself) by the Federal Drug Administration (FDA) in the USA **[16]**.

Intrathecal Granuloma: A documented complication for intrathecal catheters is development of an intrathecal granuloma. It is mainly associated with prolonged intrathecal infusions rather than limited duration intrathecal anaesthesia. It is an inflammatory mass that forms at the tip of an intrathecal catheter in response to the administration of medications **[17]**.The first intrathecal granuloma was reported in 1991 in a patient who presented with paralysis **[18]**.The prevalence of intrathecal granulomas is unknown. Reports have been published stating the prevalence is 0.1% to 5% with others documenting that the rate is up to 50%. Intrathecal granulomas develop as a result of an inflammatory process **[19]**.

Catheter Migration: It is also another serious complication that can result in new onset of exacerbated axial or radicular irritation due to the migration of the tip of the catheter. This may also result in decrease defficacy depending on the location of the tip. Changes in symptoms can be sudden and abrupt or may slowly develop over a long period of time **[20]**.

Cerebrospinal Fluid Leak: There is a risk of cerebrospinal fluid leak any time the intrathecal sac is accessed. Patients who have under gone lumbar puncture for a neurologic workup are at risk for a low-pressure cerebrospinal fluid headache as are patients on the labor and delivery ward who have had accidental Dural punctures during the Epidural placement. These complications related to cerebrospinal fluid leak and low CSF pressure can also occur following placement of an intrathecal drug delivery device **[20]**.

Spinal Myoclonus: It is characterized by focal involuntary muscular contractions **[21]**.

Traumatic Syrinx: It is a rare event related to the introduction of a catheter into the intrathecal space and the presence of its tip within the substance of the Spinal canal **[22]**.

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