FAILED SPINAL ANAESTHESIA: AN IMMEDIATE SECOND SPINAL IS A VALID OPTION IN RURAL INDIA

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ABSTRACT: BACKGROUND: Since its introduction to clinical use in 1899 by August Bier, spinal anaesthesia has stood the test of time. In the last five decades it has gained in popularity. Apart from avoiding the complications of general anaesthesia, it is a simple, reliable and a cheap procedure and is relatively easy to master. But sometimes we come across partial or complete failure of spinal anaesthesia. In our rural setup to cut the cost of anaesthesia we give second spinal anaesthesia, immediately. **METHODS:** This prospective study was undertaken in our institution for three years, from March 2010 to April 2013 to 1) determine the incidence of failed spinal anaesthesia, 2) manage such cases by giving a second spinal immediately, if surgery has not started 3) find out the intraoperative, postoperative and late complications of the second spinal, if any. All patients undergoing lower abdominal, perineal and lower limb surgeries were included. After ten minutes of giving the spinal anaesthesia with bupivacaine, if no effect was seen as determined by sensory level and motor blockade, a second spinal was given preferably at a higher level. Demographic, anaesthetic and surgical data were collected and analysed. Patients were followed up in the postoperative room and in the ward till their discharge, for any possible complications. Patients were asked to report to the hospital if they developed any problems after discharge. **RESULTS:** 140 patients out of a total number of 2450 developed partial or complete failure. 62 complained of pain after surgery had started. Of these 62, 15 were managed by giving intravenous analgesia, seven by N2O/O2 50:50 inhalation, and thirteen by manipulating the table. 27 were converted to general anaesthesia. Out of 140 patients, 78 /2450(3.18%) were given a second spinal. In all these patients, the second injection acted well giving good muscle relaxation and adequate sensory block. One patient developed high spinal soon after the second injection. Another patient developed severe bradycardia and hypotension during the surgery. There were no complications in the postoperative period. None of the patients who have come for follow up; have reported any problems related to the second spinal anaesthetic to date. **CONCLUSION:** Repeating a spinal anaesthesia after a failed one is a good method of management, if conditions permit and proper care is taken. By this all the indications for giving spinal anaesthesia in the first instance is well maintained.

KEY WORDS: spinal anaesthesia, partial failure, complete failure, second spinal, complications.

INTRODUCTION: In the early years of the 20th century there were many complications associated with spinal anaesthesia. Spinal headaches were common due to use of large sized needles. Neurological and infective complications occurred due to inadequate asepsis. But with better sterilization techniques, better training, thinner and pencil tip needles, complications have come down drastically. The problem of the single shot spinal technique is that if there is failure, we have to adopt a new technique to supplement anaesthesia and analgesia. But if it is an epidural or a combined spinal epidural, we can supplement through the epidural route. Failed spinal anaesthesia

can be partial or complete. A bupivacaine spinal anaesthetic is considered to have failed, if anaesthesia and analgesia have not been achieved within ten minutes of successful intrathecal deposition of the drug¹. Complete failure was defined as no sensory or motor blockade. Partial failure was defined as inadequate extent, quality or duration of drug action for that surgery. Management of a partial or complete failure can be achieved if surgery has not started by increasing the trendelenburg tilt or giving a second spinal anaesthetic². If surgery has already started, it can be managed by increasing the Trendelenburg tilt, asking the surgeon to inject local anaesthesia in the area, supplementing with fentanyl, nitrous oxide oxygen mixture or converting to general anaesthesia. Our study is regarding giving a second spinal in patients where there was a complete or partial failure before the start of surgery.

METHODS: This prospective study was conducted in our institution from March 2010 to April 2013. ASA I-III patients undergoing routine and emergency surgery were included. Patients with contraindications to spinal anaesthesia were excluded. All patients were evaluated clinically and investigations reviewed preoperatively. After placing monitors for non-invasive blood pressure, electrocardiogram, pulse oximetry, patients were preloaded with 500-1000ml of ringer lactate solution through an 18g cannula. Under aseptic conditions, subarachnoid block was performed in the lateral / sitting decubitus position after local skin infiltration. Sitting position was used when there was failure to locate the space in the lateral position. The intervertebral space chosen depended on the site of surgery. L3-L4 or L4-5 space was used for lower limb and perineal surgery and L2-3 space for lower abdominal surgery. We used pre sterilized company packed needles 23, 25 or 27G randomly. Free flowing clear cerebrospinal fluid was confirmed with aspiration into the syringe before the injection of the drug. The bevel was kept towards the head end. For perineal surgery 2ml, lower limb surgery 3 ml and lower abdominal surgery 3 ml of Hyperbaric (0.5%) bupivacaine was given. For caesarian sections we gave 2-2.5ml, 2.5 ml in tall patients. The extent of the sensory block was elicited by response to pin prick with a 25g needle. Inadequate sensory block was defined as ability to appreciate pain due to the pin prick below T5 level for lower abdominal surgery. The motor blockade was checked by modified Bromage scale. (0 - full movement. 1- inability to raise extended leg, but can bend the knee. 2- inability to bend knee, but can flex the ankle. 3-no movement). The level of sensory block and Bromage score and the time was recorded. If the block had not developed after five minutes, the head end was lowered to a maximum of ten degrees. After waiting for five minutes, the Bromage score and sensory level were rechecked. Mean blood pressure and heart rate were monitored. Hypotension (Blood pressure). < 80mmHg) was managed with incremental doses of mephentermine and bradycardia (Heart rate < 60/min) with atropine. Age, sex, height and weight were recorded. Indication for surgery, gauge of needle, inter space, dose of bupivacaine, position of the patient, position of the table, position of the bevel, time of injection, time taken for the development of sensory and motor blockade were recorded. If after five minutes there was no sensory or motor blockade, the used drug vial was rechecked for confirmation and for the expiry date. For those who had not developed adequate sensory and motor blockade, a second spinal anaesthesia was given using a new spinal set, one space above the previous level. But if the previous injection was at L2-L3 level it was repeated at the same site. If the first injection was given by using a 25 or 27 gauge needle, the second was given by using a 23 gauge needle. If there was complete failure, we used the full dose, but if there was partial failure, we used only 1.5 ml for perineal

surgeries and 2.5 ml for other surgeries. After the second injection the table was kept in horizontal position. All the patients were kept in the post-operative ward, till sensory block had disappeared and motor power returned. Once in the ward, the patients were screened for any headache, vomiting, nerve root pain, sensory or motor deficits, unexplained fever, backache etc. We have not included those patients who had been supplemented with general anaesthesia in whom surgery was prolonged beyond three hours, due to surgical difficulties or due to complications developing during the surgery.

RESULTS: There were 2450 patients in the study. The demographic data of the patients are as follows shown in table 1.

Anaesthesia consultants gave all of the spinals. 1020 (41.63%) were given in the lateral position, 1430 (58.36%) in the sitting position. 23g needle was used in 1772 (72.32%), 25g needle in 630 (25.71 %), 27g needle in 48(1.95%) patients. Total number of failed spinal anaesthesia was 140/2450(5.71%). In these patients, demographic values table 2 were age 44.13 +10.33 years, height 161.13 +8.56cms, weight 58.13 +9.97kgs. In the patients who had failure of spinal, 63 were done in the sitting position, 77 were in lateral position. There was free flowing cerebrospinal fluid in all, except two. Cerebrospinal fluid was barbotaged into the syringe before injection in all patients making sure that the needle tip was accurately positioned in the subarachnoid space. Thirteen patients had blood stained cerebrospinal fluid. We waited till it became clear prior to injection of drugs.

Thirteen out of 140 patients (9.28% of the failed) were managed by manipulating the table. 15/140 (10.71% of the failed) by giving i.v. sedation/ analgesia and 7/140 (5% of the failed) with O₂:N₂O by mask. 27/140 (19.28% of the failed) were given general anaesthesia, as surgery had already started. 78/140(55.71%) were given a second spinal. One patient to whom we had given a second spinal was a case of vaginal hysterectomy. Surgeon placed a small sandbag under her buttocks without our knowledge and the patient started complaining of breathlessness and inability to cough. The sensory level was at T₂. Mean arterial pressure and heart rate started falling. Airway was secured with endotracheal tube and ventilated with N₂O:O₂ in the ratio 70:30. Crystalloid fluids were infused rapidly. Mephentermine in repeated doses of 12mg i.v. and dopamine 10-15ug/kg/min infusion were given. After 40 minutes patient became stable and surgery was allowed to proceed. Another patient developed severe bradycardia and hypotension. Heart rate came down to 42 per minute and mean arterial pressure to 61 mm Hg. The sensory level was at T₄. Repeated doses 0.6mg of atropine were given to counter the effect of bradycardia repeated and it increased the heart rate. Crystalloids and mephentermine were given for hypotension. This patient was taking beta blockers, which was missed in the pre op assessment. Fourteen other patients who developed hypotension were managed by crystalloids and repeated doses of 6mg of i.v. mephentermine. There was no significant increase in the duration of muscle paralysis and sensory blockade in these patients than those who received a single shot spinal. Table 3 shows comparison of adverse effect between single shot & failed spinal anaesthesia.

DISCUSSION: True failure of spinal anaesthesia should be differentiated from failure to deposit the drug in the subarachnoid space. The failure to enter the space properly may be due to abnormalities of the spine, thickened ligamentum flavum, flexible small spinal needle, and improper positioning of

the patient or the inexperience of the person giving the block. The word failure implies that a spinal anaesthesia was attempted, but no block resulted or a block that resulted was inadequate for that surgery². Inadequacy may be related to three components of the block namely extent, quality or duration of local anaesthetic action. Levy et al³ had reported a failure rate of 17% in a university hospital in North Carolina in USA in 1985 which is not an acceptable percentage today. They had attributed the high incidence due to avoidable technical reasons. Another study in 1987 by Manchikanti et al⁴ in a community hospital found a wide variation of failure in the range of 0.46 - 35%. Steiner et al⁵ had reported a failure rate of 2.7% in 2008. The study period was 15 months and there were 71 failures in a total of 2600 patients. In 1991 Tarkkila et al⁶. Had reported a failure rate of 3.1% in 1891 patients. Our failure rate of 5.71 % (140 patients in a total of 2450) is consistent with these studies. Fettes² had done a study of managing the failed spinal by giving a second dose lower than the first dose to reduce excessive spread. Drasner and Ringler⁷ had suggested that a repeat injection after a failed spinal can be potentially unsafe. Sng et al⁸ in a study conducted in Singapore in caesarean sections had found post-partum sterilization an independent factor for partial failure with need for IV fentanyl or entonox supplementation. Our incidence of failure was sporadic. Failure was not seen with one batch of the drug alone. If one batch of the drug was defective, then all the patients who got the same batch of drug should have a failure. Since the failure was evenly distributed throughout the study, we are ruling out defective drug preparations. Inadequate concentration of local anaesthetic in the cerebrospinal fluid is a reason commonly attributed to failure. But a study conducted by Steiner et al⁵ had found that in 12 out of 20 patients, the concentration of the local anaesthetic was above 73ug/ml, a concentration that should give an adequate block. Spiegel⁹ had reported a case of post-partum sterilization in which two doses of 2% mepivacaine (44mg+40mg) and one dose of 5% lidocaine (62.5mg) failed to produce anaesthesia. Later by doing a MRI scan, it was found that the patient had a huge intrathecal volume of cerebrospinal fluid in the lumbar region. A large concentration of local anaesthetic in a small area may lead to neurotoxicity. Lee¹⁰ had reported a case of cauda equina syndrome following repeated failed spinal. In our series the second dose of spinal was effective in all patients. One patient who developed high spinal was because of placement of a sand bag kept below the buttocks, five minutes after the injection. That problem could have been avoided, if we were more alert. In one patient who developed severe bradycardia and hypotension, we had missed the fact that the patient was taking beta blockers. This shows the importance of history taking. The beta blockers were not mentioned in the case sheet. On questioning the patient on the table, it was revealed that he had forgotten to mention it to the doctors. Beta blockers reduce the contractility of myocardium and heart rate. When the level of spinal anaesthesia gets higher, body may not be able to compensate for hypotension and bradycardia by increasing the force of contraction and the heart rate. After analyzing between single shot spinal and 2nd spinal anaesthesia we found that bradycardia and hypotension that developed in the other patients in our series cannot be attributed to second spinal alone. It is a normal side effect seen with any spinal. The period of recovery from sensory block and motor block was same as for patients who received a single shot of spinal. There was no prolongation of anaesthesia and analgesia. There were no late complications like backache, post spinal headache, transient neurological symptoms or infective complications till discharge. Two male patients could not pass urine in the post-operative ward and had to be catheterized. This cannot be attributed to the second spinal alone. There were many limitations to our study. The number of patients was not very large.

The average post-operative stay in the hospital was eight days. We had used only hyperbaric 0.5% bupivacaine as this is the only drug available in our institution. We should have tried other drugs too. By giving a second spinal we have maintained the indications of regional technique and from the economic point of view, kept the cost down.

CONCLUSION: We conclude that giving a second spinal is a safe and reliable method of management of failed spinal. But since the volume of drug inside the CSF is large after the second spinal, we have to take care about the position of the table. If the head end is lowered, there is a possibility of high spinal or total spinal. To make the second spinal successful, cooperation from the surgeon is essential. They have to wait 10-15 minutes after the first spinal to know whether it has acted or not. If the surgery is urgent we have to convert to general anaesthesia to save time. In the current literature only two attempts are recommended since multiple punctures can inflict nerve and vascular injuries.

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Table 1 – Demographic data of n=2450 patients in series

	Mean	S.D.
Age (Years)	45.86	+14.09
Weight (kegs)	64.33	+10.52
Height (cms)	153.5	+1.4
Males	1200/2450	48.97%
Females	1250/2450	51.02%
ASA I	1212/245	49.46%
ASA II	832/2450	33.95%
ASA III	406/2450	16.57%

Table 2 – Demographic data of failed spinal anaesthesia n=140 patients.

	Mean	S.D.
Age (yrs)	44.13	+10.33yrs
Weight (kegs)	58.13	+9.97kgs
Height (cms)	161.13	+8.56cms
Males	38/78	48.71%
Females	40/78	51.28%
ASA I	42/78	53.84%
ASA II	28/78	35.89%
ASA III	8/78	10.25%

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Table 3 – Comparison of adverse effects between single shot & failed spinal anaesthesia

Adverse Effects		Single shot spinal n=2110		Failed spinal n=140	
1.	Bradycardia	854/2110	40.47%	38/78	48.75%
2.	Hypotension	437/2110	20.75%	19/78	24.35%
3.	Nausea-Vomiting	736/2110	34.38%	26/78	33.33%
4.	Post spinal headache	485/2110	22.98%	20/78	25.65%
5.	Transient Neurological symptoms	378/2110	17.91%	16/78	20.51%

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