Failed spinal anaesthesia- management by giving a second spinal

AA Abraham[1], Jacob Philip[2]
Associate Professor[1], Postgraduate student[2], Department of Anaesthesiology,
Yenepoya Medical College, Mangalore, 575018, India.

***Corresponding author*:jljaa@hotmail.com**

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.

Methods:
This prospective study was undertaken in our institution for one year, from December 2009 to November 2010 to1) 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, post-operative 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:
42 patients out of a total number of 1673 developed partial or complete failure.19 complained of pain after surgery had started. Of these 19, five were managed by giving intravenous analgesia, one N_2O/O_2 50:50 inhalation, and three by manipulating the table.11 were converted to general anaesthesia. Out of 42 patients, 23 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 post-operative 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 anaesthetic 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 preserved.

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 drug. 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 anaesthetic.

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 December 2009 to November 2010.ASA I-III patients undergoing routine and emergency surgery were included. Patients with contraindications to spinal, combined spinal epidurals, spinals with additives were excluded. After institutional ethics committee approval and informed written consent, all patients were evaluated clinically and investigations reviewed preoperatively. For routine cases, ranitidine 150mg and lorazepam 1mg were given orally the night before surgery. In the morning glycopyrrolate 0.2mg i.m. and lorazepam 1 mg orally were given.

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. A senior anaesthesiologist supervised whenever postgraduate students and interns were giving the spinal. Under aseptic conditions, subarachnoid block was performed in the lateral decubitus position after local skin infiltration. Sitting position was used only when there was failure to locate the space in the lateral position. The intervertebral space chosen depended on the site of surgery. L_3-L_4 or L_4-$_5$ space was used for lower limb and perineal surgery and L2-3 space for lower abdominal surgery. We used pre sterilized company packed Quincke 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 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 T_5level 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 was managed with incremental doses of mephenteramine and bradycardia with glycopyrrolate.

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. The seniority of person giving the block was also 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 L_2-L_3 level it was repeated at the same site. If the first was given by a postgraduate student or intern, the second was given by a senior staff, 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 1673 patients in the study. The demographic data of the patients are as follows. (Table 1)

Table 1 – Demographic data

Age (Years)	45.86 ± 14.09
Weight (kg)	64.33 ±10.52
Height (cms)	153.5 ± 1.4
Males	1209
Females	464
ASA I	704
ASA II	635
ASA III	334

Anaesthesia staff gave 603 of the spinals (36.04%), postgraduate students 1040(62.16%), interns under supervision 30 (1.79%). 1261 (87.3%) were given in the lateral position, 212 (12.67%) in the sitting position. 23g needle was used in 1442 (87.19%), 25g needle in 210 (12.55 %), 27g needle in 21(1.61%) patients.

Total number of failed spinal anaesthetics was 42(2.5%). In these patients, demographic values 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, 3 were done in the sitting position, 39 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. Three patients had blood stained cerebrospinal fluid. We waited till it became clear prior to injection of drugs. Three were given by staff and 39 were given by postgraduate students. (Table 2)

Table 2. Details of the first spinal which had failed for whom second spinal was given

SL. NO	AGE	SEX	WEIGHT K.G	HEIGHT C.M	GIVEN BY WHOM	POSITON	NEEDLE GAUGE	CLEAR OR NOT	POSITION OF TABLE	POSITION OF BEVEL
	31	F	51	157	PG	L	23	C	HORIZONTAL	CEPHALIC
	35	M	62	172	PG	L	25	C	H	CE
	55	M	63	170	PG	L	25	C	H	CE
	49	F	55	169	F	L	23	C	H	CE
	40	M	45	150	INT.	S	23	C	H	CE
	51	M	60	154	PG	L	27	C	H	CE
	41	M	55	165	INT.	L	25	C	H	UP
	35	F	60	151	F	L	25	NOT	H	CE
	55	F	50	149	PG	L	23	C	H	CE
	49	M	72	158	INT.	L	23	C	H	CE
	51	M	50	154	PG	L	23	C	H	CE
	44	M	71	160	PG	L	23	C	H	CE
	40	M	56	164	PG	S	27	C	H	CE
	45	M	61	171	PG	L	25	C	H	CE
	21	M	35	157	PG	L	23	C	H	CE
	42	M	63	151	PG	L	23	C	H	CE
	31	M	51	150	F	L	23	NOT	H	CE
	30	F	72	176	PG	L	25	C	H	CE
	50	M	54	159	F	L	23	C	H	CE
	42	F	49	160	PG	S	27	C	H	UP
	51	M	60	165	PG	L	25	C	H	CE
	58	M	62	170	PG	L	23	C	H	CE
	69	M	80	174	PG	L	23	C	H	CE

Legends: PG- Post Graduate Students F- Faculty Member INT-Intern L-Lateral S-Sitting

Three patients (7.1% of the failed) were managed by manipulating the table. Five (11.9% of the failed) by giving i.v. sedation/ analgesia and one with O_2:N_2O by mask. 11 (26.1%) were given general anaesthesia, as surgery had already started. 23(54.7%) 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 N_2O:O_2 in the ratio 70:30. Crystalloid fluids were infused rapidly. Mephentaramine in repeated doses of 12mg i.v. and dopamine 10-15ug/kg/min infusion were given. After 30 minutes patient became stable and surgery was allowed to proceed.

Another patient developed severe bradycardia and hypotension. Heart rate came down to 32 and mean arterial pressure to 51 mm Hg. The sensory level was at T4.Repeated doses of atropine and glycopyrrolate failed to increase the heart rate. Later heart rate came up with infusion of isoprenaline 0.1ug/kg/min**.** Crystalloids and mephentaramine 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.mephentaramine. 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.

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 surgery[1]. Inadequacy may be related to three components of the block namely extent, quality or duration of local anaesthetic action.

Jeffrey H Levy et al[2] 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 L et al in a community hospital found a wide variation of failure in the range of 0.46 -35% [3].

Steiner LA et al had reported a failure rate of 2.7% in 2008[4]. The study period was 15 months and there were 71 failures in a total of 2600 patients. In 1991 Tarkkila[5]et al had reported a failure rate of 3.1% in 1891 patients. Our failure rate of 2.5 % (42 patients in a total of 1673) is consistent with these studies.

Fettes PDW had done a study of managing the failed spinal by giving a second dose lower than the first dose to reduce excessive spread[1]. Drasner K, Ringler M.L. had suggested that a repeat injection after a failed spinal can be potentially unsafe[6].

Sng BL et al 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[7.] We had 12 post-partum sterilizations in our study with no failure. These 12 cases are only 0.71% of our total cases and we consider it not significant. Moreover surgical indications cannot determine the outcome of the success of spinal anaesthesia.

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 year, 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 L.A Steiner[4] 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.

Spiegl JE[8] 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. Lee H had reported a case of cauda equina syndrome following repeated failed spinal[9].

In our series the second dose of spinal acted 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.

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.

We had excluded the patients in whom fentanyl,clonidine or buprenorphine were added to the local anaesthetic. The addition of these agents make the onset faster, prolong the duration of anaesthesia and produce post-operative sedation. By adding these drugs, we could have reduced the failure rate.

There were many limitations to our study. The number of patients was very small. The average post-operative stay in the hospital was eight days. We had used only bupivacaine as this is the only drug available in our institution. We should have tried other drugs too. 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.

By giving a second spinal we have preserved 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 spinals. 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, co-operation 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[10].

References:

1.Fettes PDW, Jannson JR, Wildsmith JAW. Failed spinal anaesthesia: mechanisms management and prevention.Br J Anaesth 2009;**102(6)** :739-748. http://dx.doi.org/10.1093/bja/aep096 PMid:19420004

2. Levy JH, Islas JA, Ghia JN et al.A

retrospective study of the incidence and causes of failed spinal anesthesia in a university hospital.AnesthAnalg 1985;**64**:705-10. http://dx.doi.org/10.1213/00000539-198507000-00010
PMid:4014732

3. Manchikanti L, Hadley C, Markwell SJ, Colliver JA. A retrospective analysis of failed spinal anesthetic attempts in a community hospital.AnesthAnalg 1987;**66**:363-6. http://dx.doi.org/10.1213/00000539-198704000-00017
PMid:3565803

4. Steiner LA, Hauen Stein L, Ruppen W et al. Bupivacaine concentration in lumbar cerebro spinal fluid in patients with failed spinal anaesthesia. Br J Anaesth 2009;**102**:839-844. http://dx.doi.org/10.1093/bja/aep050
PMid:19329469

5. Tarkkila, Pekka Juhani. Incidence and causes of failed spinal anaesthetics in a university hospital: a prospective study. RegAnaesth 1991;**16(1):**48-51.

6. Drasner K, Ringler M.L. Repeat injection after a failed spinal: at times, a potentially unsafe practice. Anaesthesiology 1991;**75**:713-4. http://dx.doi.org/10.1097/00000542-199110000-00042

7. Sng BL, Lim Y, Sia ATH. An observational prospective cohort study of incidence and characteristics of failed spinal anaesthesia for caesarean section .Int J ObstetAnesth 2009; **18**:237-241. http://dx.doi.org/10.1016/j.ijoa.2009.01.010
PMid:19450971

8. Spiegel JE, Hess P. Large intrathecal volume: a cause of true failed spinal anaesthesia. J Anesth 2007;**21(3)**:399-402. http://dx.doi.org/10.1007/s00540-007-0510-5
PMid:17680194

9. Lee H, Shin I, Sohn J, Chung Y. Cauda equine syndrome following repeated failed spinal. RegAnaesth 2008;**33(5)**:P e43. http://dx.doi.org/10.1016/j.rapm.2008.07.088

10. Lapale Moipolai. Failed spinal anaesthesia. http://www.sajra.co.za/articles/failedspinal.pdf

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